Securitization, Transparency and Liquidity

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Abstract

We present a model in which issuers of asset backed securities choose to release coarse information to enhance the liquidity of their primary market, at the cost of reducing secondary market liquidity or even causing it to freeze. The degree of transparency is inefficiently low if the social value of secondary market liquidity exceeds its private value. We analyze various types of public intervention – mandatory transparency standards, provision of liquidity to distressed banks or secondary market price support – and find that they have quite different welfare implications. Finally, transparency is greater if issuers restrain the issue size, or tranche it so as to sell the more information-sensitive tranche to sophisticated investors only.

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1 Introduction

It is widely agreed that the securitization of mortgage loans has played a key role in the 2007-08 subprime lending crisis (Adrian and Shin, 2008; Brunnermeier, 2008; Gorton, 2008; and Kashyap, Rajan and Stein, 2008, among others). In particular, it is commonplace to lay a good part of the blame for the crisis on the poor transparency that accompanied the massive issues of asset backed securities (ABS), such as mortgage backed securities (MBS) and collateralized debt obligations (CDO): see for instance Financial Stability Forum (2008) and IMF (2008).

Both securities issuers and rating agencies are responsible for the lack of transparency of the securitization process. The prospectus of MBS only provided summary statistics about the typical claim in the underlying pool. Even though detailed information on the underlying mortgage loans was available from data providers, subscription to these data sets is expensive and considerable skills are required to analyze them. As a result, most investors ended up relying on ratings, which simply assess the default probability of the corresponding security (S&P and Fitch) or its expected default loss (Moody's). These statistics capture only one dimension of default risk, and fail to convey an assessment of the systematic risk of CDOs, as pointed out by Coval, Jurek and Stafford (2008) and Brennan, Hein and Poon (2008), and of the sensitivity of such systematic risk to macroeconomic conditions, as noted by Bemmelech and Dlugosz (2008). Moreover, in their models, rating agencies assumed correlations of defaults in CDO portfolios to be stable over time, rather than dependent on economic activity, house prices and interest rates.[1]

[1]Ratings were coarse also in the sense that they were based on a very limited number of loan-level variables, to the point of neglecting indicators with considerable predictive power (Ashcraft, Goldsmith-Pinkham and Vickery, 2009). Indeed, it was only in 2007 that Moody's requested from issuers loan-level data that itself considered to be "primary", such as a borrower's debt-to-income (DTI) level, the appraisal type, and the identity of the lender that originated the loan (Moody's, 2007). This is in spite of the fact that traditionally the borrower's DTI is one of the most important measures of a mortgage default risk, and the identity of the originating lender is highly significant in predicting subsequent rating downgrades of the same asset-backed securities, as documented by Johnson, Faltin-Traeger and Mayer (2009) for S&P ratings. In addition, rating agencies failed to re-estimate their models over time to take into account the worsening of the loan pool induced by

The implied information loss is seen by many not only as the source of the pre-crisis mispricing of ABS but also as the reason for the subsequent market illiquidity: after June 2007, the market for ABS shut down, because most market participants did not have enough information to price and trade these securities. This market freeze created an enormous overhang of illiquid assets on banks' balance sheets, which in turn resulted in a credit crunch (Brunnermeier and Pedersen, 2009).

However, the links between securitization, transparency and market liquidity are less than obvious. If the opaqueness of the securitization process affects the liquidity of ABS, why should their issuers choose opaqueness over transparency? After all, if the secondary market is expected to be illiquid, the issue price should be lower.[2] But the pre-crisis behavior of issuers and investors alike suggests instead that they both saw considerable benefits in securitization based on relatively coarse information. The fact that this process is now highlighted as a major inefficiency suggests that there is a discrepancy between the private and the social benefits of transparency in securitization. What is the source of the discrepancy, and when should it be greatest? How do different forms of public intervention compare in dealing with the problem? These questions are crucial in view of the current plans of reforming financial regulation in both the United States and Europe.

In this paper, we propose a model of the impact of transparency on the market for structured debt products that addresses these issues. Issuers may wish to provide coarse information about the pools of claims underlying their ABS in order to expand the size and liquidity of their primary market. This is because few potential buyers are sophisticated enough to understand the pricing implications of complex information, such as that required to assess the systematic risk of ABS, i.e. the covariance between default losses and the marginal utility of consumption. Releasing such information

securitizations themselves (Rajan, Seru and Vig, 2008).

[2]This insight is consistent with the results by Fahri, Lerner and Tirole (2008), who present a model where sellers of a product of uncertain quality buy certification services from information certifiers. In their setting, sellers always prefer certification to be transparent rather than opaque.

would create a "winner's curse" problem for unsophisticated investors in the issue market. This is one instance of a more general pattern: when some investors have limited ability to process information, releasing more public information may increase adverse selection and so reduce market liquidity. Incidentally, this underscores the point that the standard thesis that transparency enhances liquidity hinges on the assumption that market participants are all equally skilled at information processing and asset pricing – an assumption that is particularly unrealistic with reference to complex securities such as ABS.[3]

But while opaqueness enhances liquidity in the primary market, it may reduce it, even drastically, in the secondary market, and cause ABS prices to decline more sharply in case of default. This is because the information not disclosed at the issue stage may still be uncovered by sophisticated investors later on, especially if it enables them to earn large rents in secondary market trading. This is witnessed by a survey conducted by the Committee on the Global Financial System in 2005: "Interviews with large institutional investors in structured finance instruments suggest that they do not rely on ratings as the sole source of information for their investment decisions ... Indeed, the relatively coarse filter a summary rating provides is seen, by some, as an opportunity to trade finer distinctions of risk within a given rating band. Nevertheless, rating agency 'approval' still appears to determine the marketability

[3] The point that disclosing information about securitized assets may hinder their liquidity is also made intuitively by Holmstrom (2008). He draws a parallel with the sale of wholesale diamonds, which de Beers sells in pre-arranged packets at non-negotiable prices, and argues that this selling method is aimed at eliminating the adverse selection costs that would arise if buyers were allowed to negotiate a price contingent on the packets' content. Similarly, Kavajecz and Keim (2005) show that asset managers are able to achieve a 48% reduction in trading costs via "blind auctions" of stocks, whereby they auction a set of trades as a package to potential liquidity providers, without revealing the identities of the securities in the package to the bidders. Kim and Verrecchia (1994) have applied this idea to the effects of earnings announcements: they show that if the information in these announcements allows sophisticated traders to increase their informational advantage over other traders, announcements lead to lower market liquidity. The same argument is used by Goel and Thakor (2003) to rationalize earning smoothing: a company that wishes to maintain a liquid market for its stock will smooth earnings so as to reduce the informational rents of sophisticated investors.

of a given structure to a wider market" (p. 3).[4] So limiting transparency at the issue stage shifts the adverse selection problem to the secondary market, reducing its liquidity or even inducing it to freeze. In choosing the degree of transparency, issuers effectively face a tradeoff between primary and secondary market liquidity.

Their choice of transparency will depend on the value that investors are expected to place on secondary market liquidity, and on the severity of adverse selection in the primary market. If secondary market liquidity is valuable and adverse selection would not trigger a large initial underpricing, then issuers will choose to release detailed information even at the cost of some reduction in primary market liquidity. Conversely, if investors care little about secondary market liquidity and adverse selection would induce a large initial underpricing, then issuers will go for coarse information.

In general, however, the degree of transparency chosen by issuers will fall short of the socially optimal whenever secondary market liquidity has a social value in excess of its private one. This will be the case if a secondary market freeze triggers a cumulative process of defaults and premature liquidation of assets in the economy, for instance because banks' interlocking debt and credit positions create a gridlock effect. In this case, the socially efficient degree of transparency is higher than that chosen by the issuers of structured bonds, thus creating a rationale for regulation. In practice, regulation can raise the transparency of the securitization process either by requiring issuers of structured debt to release more detailed data about the underlying loan pools or by requiring rating agencies to provide more sophisticated ratings: for instance, multidimensional ratings that not only estimate the probability of default, but also the correlation of default risk with aggregate risk. We find that mandatory transparency is likely to be socially efficient when secondary market liquidity is very valuable and adverse selection in the primary market is not too severe. Nevertheless, such regulation does have a cost in terms of reduced liquidity at the issue stage.

[4]Some investors may have had superior information even at the issue stage, as the yield spreads at issuance for low-rated MBS impounded fundamental information in excess of that contained in the ratings (Adelino, 2009).

We also analyze the effects of two forms of *ex-post* public liquidity provision: one targeted to distressed bondholders in case of market freeze, and one intended to support the ABS secondary market price. The former is ex-post efficient but reduces the issuers' ex-ante incentives to opt for transparency, because it lowers the costs of secondary market illiquidity associated with opaqueness. This increases the value of opaque compared to transparent securities, and has the undesirable consequence of expanding the parameter region where opaqueness and market freeze occur. An intervention aimed at supporting the ABS market price is even more misguided, however: the liquidity injected by the government simply attracts more informed trading, and provides no relief to distressed bondholders who seek liquidity.

Finally, we show that if issuers accept a degree of "restraint" in their issue size or if they tranche the issue, the area in which transparency is privately optimal expands: a transparent rating no longer causes adverse selection in the primary market if the issue size is such that sophisticated investors alone can buy it and is priced to appeal only to them. The gain to the issuer is a smaller discount; the cost, a lower volume. Tranching is an even better way to address the problem, if tranches are designed and priced so that sophisticated investors purchase the risky, information-sensitive tranche while unsophisticated ones buy the safe and information-insensitive one. We show that the issuer will always opt for tranching, sell the senior tranche entirely and at most retain part of the junior tranche. Moreover, if sophisticated investors have enough wealth to absorb a large enough portion of the junior tranche, the issuer will opt for transparency. So, tranching expands the parameter region in which issuers will choose transparency, which shows that tranching also has a bright side, and is not only a tool to gain from mispricing, as argued by Brennan, Hein and Poon (2008).

This argument is akin to that of Gorton and Pennacchi (1990), that the trading losses associated with information asymmetry can be mitigated by designing securities with cash flows that are insensitive to private information and which can therefore be safely bought by uninformed investors who seek them only for their liquidity needs. An even closer argument is offered by Plantin (2004), who shows that when asset-backed securities are sold to heterogenous investors, it is optimal for the sophisticated ones to concentrate on the most junior tranches and leave more senior tranches to the unsophisticated, which reduces adverse selection on the senior and spurs information collection on the junior tranches.[5]

It is worth noticing that, while our model explains why issuers may opt for coarse and uninformative ratings, it does not imply that on average ratings will be inflated. In this sense, our setting differs from recent models where ratings are inflated by the issuers' ability to engage in "rating shopping" (Skreta and Veldkamp, 2009, and Spatt, Sangiorgi and Sokobin, 2009), and possibly collude with rating agencies (Bolton, Freixas and Shapiro, 2009). In our setting, rating agencies report information faithfully: in the opaque regime, they simply do not disclose security characteristics that most investors would be unable to price.[6] In practice, both the coarseness of ratings and their inflation due to rating shopping and collusion are likely to have played a role in the crisis, and indeed may have amplified each other's effects.

The paper is organized as follows. Section 2 lays out the structure of the model. Section 3 solves for the equilibrium secondary market prices, and 4 characterizes the issuer's choice between opaqueness and transparency. In Section 5 we determine the cases in which the socially efficient level of transparency may be higher than the privately optimal level, and consider various forms of public intervention, some ex-ante such as mandatory transparency, and other ex-post, such as liquidity provision in the secondary market for ABS. In Section 6 we explore the implications of letting the issuer choose the size of the ABS issue or its tranches, beside the degree of transparency. Section 7 concludes.

[5] The latter idea – that tranching is beneficial because it elicits information collection by sophisticated investors – is already present in Boot and Thakor (1993).

[6] Another difference is that our unsophisticated investors rationally take into account their unsophistication in their investment decisions, while rating shopping models assume some naïve investors who are gullied by inflated ratings.

2 The Model

An issuer owns a continuum of measure 1 of financial claims, such as mortgage loans or corporate bonds, and wants to sell them because the proceeds can be invested elsewhere for a net return $r > 0$. For brevity, we shall refer to these financial claims simply as "loans".

There are three future states of nature: a good state (G), which occurs with probability p, and two bad states (B_1 and B_2), occurring with probability $(1-p)/2$ each. The good state corresponds to an economic expansion, while of two bad states, B_1 corresponds to a mild slowdown in which only some sectors of the economy fare badly, while B_2 is a sharp contraction of aggregate consumption. Therefore, the marginal utility of future consumption is highest in state B_2, intermediate in state B_1 and lowest in state G, that is, $q_{B2} > q_{B1} > q_G$, where q_s denotes the stochastic discount factor of state-s consumption. For simplicity, the risk-free interest rate is set at zero, that is, the price of a certain unit of future consumption is one: $pq_G + [(1-p)/2](q_{B1} + q_{B2}) = 1$.

Table 1. Loan Payoffs

State	Probability	Payoff of type-1 claim	Payoff of type-2 claim	State price	Payoff of claim pool
G	p	1	1	pq_G	1
B_1	$(1-p)/2$	x	0	$\frac{1-p}{2}q_{B1}$	λx
B_2	$(1-p)/2$	0	x	$\frac{1-p}{2}q_{B2}$	$(1-\lambda)x$

The issuer's pool is formed by two types of loans, 1 and 2, in proportions λ and $1-\lambda$ respectively. As shown in Table 1, both type-1 and type-2 loans pay 1 unit of consumption in state G, but have inversely correlated payoffs in bad states: type-1 loans yield $x < 0$ units of consumption in state B_1 and 0 in state B_2, while the opposite is true of type-2 loans. Therefore, type-2 loans are more sensitive to aggregate risk than type-1 loans, and accordingly are less valuable, the difference between their state prices being $[(1-p)/2](q_{B2}-q_{B1})x>0$.

A key assumption of the model is that correct pricing of the payoffs in states B_1 and B_2 requires a complex pricing model known only to a fraction μ of highly sophisticated investors (say, hedge funds), but unknown to the remaining $1-\mu$ investors as well as to the issuer.[7] These unsophisticated players only know the average discount factor for the two states $q_B=(q_{B1}+q_{B2})/2$, but not its two components: they know that one state is worse than the other, but ignore which. Moreover, we assume that acquiring such pricing skills is prohibitively costly for them.

2.1 Securitization

We assume that the issuer must sell these claims as a portfolio because selling them one-by-one would be prohibitively costly.[8] The portfolio's payoff is 1 in state G when both loan types do well, λx in state B_1 and $(1-\lambda)x$ in state B_2. The portfolio is sold as an ABS, promising to repay a face value $F=1$, which will be shown to be the face value that issuers will choose in equilibrium. So the ABS's payoff equals its face value F only in the good state, while default occurs in the two bad states. So the probability of default is $1-p$, and the expected loss from default is $(1-p)(1-x)$.

The actual pool composition λ in any period is random: with equal probability it takes a low value $\lambda_L=1/2-\sigma$ or a high value $\lambda_H=1/2+\sigma$, where $\sigma\leqslant 1/2$ ensures that $\lambda\in[0,1]$. Therefore, on average the pool is balanced ($E(\lambda)=1/2$) and

[7] The assumption that the issuer does not know about some price-relevant characteristics of his asset, but can learn of them from specialized intermediaries or investors is commonplace in the literature on IPOs, and motivates the book-building method for IPO sales (see Benveniste and Spindt, 1989, among others). A similar assumption is made by Dow, Goldstein, and Guembel (2007) and Hennessy (2008), who show that companies may gain information about their investment opportunities from market prices.

[8] The high cost is because the payoff of each claim has an idiosyncratic random component that is known to the issuer and can be certified by the rating agency at a cost but unknown to investors. So overcoming adverse selection problems would require each individual claim to be rated by the agency – as noted, a prohibitive expense. Pooling the claims diversifies away this idiosyncratic risk, removing the need for the rating agency to perform the detailed assessment.

the standard deviation σ measures uncertainty about λ. Instead of λ, below it will often be convenient to use the deviations from its mean $\widetilde{\lambda} \equiv \lambda - 1/2$, which equal $-\sigma$ or σ with equal probability.

The randomness of the portfolio composition adds a layer of complexity to the ABS payoff structure relative to that of its underlying claims. For the ABS, there are six payoff-relevant states rather than three, because λ creates uncertainty about the ABS's exposure to systematic risk, as illustrated in Table 2. Specifically, since a high realization of λ lowers the payoff in the worst state (B_2) while raising it in the intermediate state (B_1), it corresponds to a higher systematic risk. Therefore, λ measures the ABS systematic risk in each contingency.

Table 2. ABS Payoffs

State	Probability	ABS payoff	State price
G, $\lambda = \lambda_H$	$\frac{p}{2}$	1	$\frac{p}{2} q_G$
B_1, $\lambda = \lambda_H$	$\frac{1-p}{4}$	$\lambda_H x = \left(\frac{1}{2} + \sigma\right) x$	$\frac{1-p}{4} q_{B1}$
B_2, $\lambda = \lambda_H$	$\frac{1-p}{4}$	$(1 - \lambda_H)x = \left(\frac{1}{2} - \sigma\right) x$	$\frac{1-p}{4} q_{B2}$
G, $\lambda = \lambda_L$	$\frac{p}{2}$	1	$\frac{p}{2} q_G$
B_1, $\lambda = \lambda_L$	$\frac{1-p}{4}$	$\lambda_L x = \left(\frac{1}{2} - \sigma\right) x$	$\frac{1-p}{4} q_{B1}$
B_2, $\lambda = \lambda_L$	$\frac{1-p}{4}$	$(1 - \lambda_L)x = \left(\frac{1}{2} + \sigma\right) x$	$\frac{1-p}{4} q_{B2}$

The issuer knows all the characteristics of the portfolio: the probability of repayment p, the loss in each default state (x or 1), the distribution of λ and its realized value. He can choose between two regimes: an "opaque" regime where all the parameters are disclosed but the realization of λ is not, and a "transparent" regime where also λ is disclosed. In both cases he credibly certifies the information via a rating agency (for simplicity, at a negligible cost). The agency is assumed to be trustworthy, due to penalties or reputational costs for misreporting. Note that the information available in the opaque regime is akin to that reflected in real-world ratings, where S&P and Fitch estimate the probability of default $1 - p$ and Moody's assesses the expected loss from default $(1 - p)(1 - x)$.

However, the information revealed in the opaque regime is not sufficient to price the ABS correctly, even for sophisticated investors. To this purpose, investors also need to know the actual composition of the loan pool, λ, and all three state prices. This is because λ determines the sensitivity of the ABS's payoff to aggregate risk, and the state prices $(1-p)q_{B1}/2$ and $(1-p)q_{B2}/2$ determine the valuation of this risk. In the transparent regime, only sophisticated investors are in this situation, and will correctly compute the risk-adjusted PDV of the ABS.

For concreteness, suppose that in the opaque scenario each of the ratings published by the agency (Aa1, Aa2, Aa3, A1, A2, A3, Baa1, Baa2, Baa3, etc.) corresponds to possible values of p. For instance, if p can take 15 values, there are 15 possible ratings. In the transparent scenario, the number of possible ratings is compounded by the number of possible realizations of λ. Since in our setting λ can take one of two values, the number of possible ratings escalates to 30. Alternatively, the rating agency can issue a bi-dimensional rating, the two dimensions being the ABS repayment probability p and its aggregate risk sensitivity λ. In either case, with transparency the rating is defined on a more finely partitioned information set.

In the opaque scenario, investors ignore the true ABS payoffs λx and $(1-\lambda)x$ in the two default states B_1 and B_2, and must estimate them using the average loan composition (1/2), so that they compute the risk-adjusted PDV of the ABS as

$$V_O = pq_G + \frac{1-p}{2}x\left(\frac{1}{2}q_{B1} + \frac{1}{2}q_{B2}\right) = pq_G + \frac{1-p}{2}xq_B, \tag{1}$$

where the subscript O stands for "opaque". So in this regime the superior pricing ability of sophisticated investors (i.e., their ability to price separately consumption in states B_1 and B_2) is irrelevant.

In the transparent scenario, instead, sophisticated investors – equipped with information about the actual loan pool quality λ – will correctly estimate the PDV of the ABS as

$$\begin{aligned} V_T(\lambda) &= pq_G + \frac{1-p}{2} x \left[\lambda q_{B1} + (1-\lambda) q_{B2}\right] \\ &= V_O - \frac{1-p}{2} x \widetilde{\lambda} (q_{B2} - q_{B1}). \end{aligned} \tag{2}$$

The expression on the second line shows that with transparency the correct valuation of the ABS, V_T, is equal to the opaque-regime valuation V_O minus a term proportional to $\widetilde{\lambda}$, i.e. the deviation of the ABS aggregate risk sensitivity λ from its average. This term captures the superior risk-pricing ability of sophisticated investors.

In contrast, unsophisticated investors will price the payoffs λx and $(1-\lambda)x$ at the same average state price $(1-p)q_B/2$, and therefore will end up estimating again the PDV of the ABS as expression (1). Therefore, they will misprice the ABS: if the sensitivity of the ABS to aggregate risk is high ($\widetilde{\lambda} = \sigma$), they will overestimate its PDV by

$$(1-p)\frac{\sigma x}{2}\left(q_{B2} - q_{B1}\right), \tag{3}$$

and in the opposite case ($\widetilde{\lambda} = -\sigma$), they will underestimate it by the same amount. As unsophisticated investors incur into either one of these two pricing errors with equal probability, the same expression measures their average mispricing. The size of the mispricing is increasing in the variability of the ABS risk sensitivity, σ, and in the difference between the two state prices $((1-p)/2)(q_{B2} - q_{B1})$. By the same token, expression (3) also measures the informational advantage of sophisticated investors, or more precisely their expected informational rent $(1-p)R$: as we shall see, whenever they know λ, sophisticated investors can extract a rent

$$R \equiv \frac{\sigma x}{2}\left(q_{B2} - q_{B1}\right), \tag{4}$$

in default states, that is, with probability $1-p$. However, unsophisticated investors are fully rational: they realize to be at an informational disadvantage when bidding in the initial ABS sale under transparency, or when trading in the secondary market under opaqueness (if some sophisticated investors have become informed later on).

Sophisticated investors are assumed to lack the wherewithal to buy the entire ABS issue. Since the price they would offer for the entire issue is the expected ABS payoff conditional on the realized λ, the relevant condition is that their total wealth $A_S < V_T(\lambda_L)$.[9] In contrast, unsophisticated investors are sufficiently wealthy to absorb the entire issue: their wealth $A_U > V_O$, since their offer price for the entire ABS issue is the unconditional expectation of its payoff.[10] As in Rock (1986), these assumptions imply that for the issue to succeed, the price of the ABS must be such as to induce participation by the unsophisticated investors.

2.2 Time Line

The time line is shown in Figure 1. At the initial stage 0, the composition of the pool (λ) is determined, and the issuer learns it.

At stage 1, the issuer chooses either transparency or opaqueness, the rating agency reveals the corresponding information, and the ABS is sold on the primary market at price P_1 via a uniform price auction.[11]

At stage 2, people learn whether the ABS is in default or not. At the same time, a fraction π of the initial pool of investors is hit by a liquidity shock and must decide whether to sell their stake in the secondary market or else to liquidate other assets at a fire-sale discount Δ. (Alternatively, Δ may be seen as the investors' private

[9] The relevant constraint arises when $\lambda = \lambda_L$. In fact, if $A_S \in (PDV(\lambda_H), PDV(\lambda_L)]$, sophisticated investors can buy the entire issue if $\lambda = \lambda_H$ at its PDV. If instead $\lambda = \lambda_L$, sophisticated investors are not wealthy enough, so unsophisticated investors are needed. However, the latter cannot distinguish between the two scenarios and can only participate in both cases or in neither. Hence, if A_S is in this range, placing the issue in all contingencies requires that prices are set so as to draw uninformed investors into the market.

[10] We assume that agency problems in delegated portfolio management prevent unsophisticated investors from entrusting enough wealth to sophisticated ones as to overcome this limited wealth constraint.

[11] In principle, the issuer may rely on another type of auction so as to elicit pricing information from sophisticated investors, such as a bookbuilding method. However, even in this case sophisticated investors would earn some informational rents at the issue stage in the transparent regime, whereas they would not in the opaque one.

cost of failing to meet obligations to their lenders or the penalty for recalling loans or withdrawing lines of credit.) Liquidity risk is idiosyncratic and therefore uncorrelated with CDO payoffs, and for simplicity is assumed to be insurable at a fair rate. If default is announced, the sophisticated investors not hit by the liquidity shock may try to acquire costly information about λ to trade on it, unless of course λ was already disclosed at stage 1. Their probability ϕ of discovering λ is increasing in the resources spent on information acquisition: they learn it with probability ϕ by paying a cost $C\phi$. Sophisticated investors choose how much to spend on information acquisition once liquidity sellers' participation decision is known, which avoids equilibrium existence problems.

At stage 3, secondary market trading occurs. Competitive market makers set bid and ask quotes for the ABS so as to make zero profits, and investors who have chosen to trade place orders with them. Market makers are sophisticated, in that they are able to draw the pricing implications of the realized value of λ, if this is publicly disclosed. Moreover, they have sufficient market-making capital as to absorb the combined sales of liquidity and of informed traders.

At stage 4, the payoffs of the underlying portfolios and of the ABS are realized.

This sequence of moves assumes that under opaqueness sophisticated investors wait for the secondary market trading to invest in information collection, rather than seeking it before the initial sale of the ABS. The rationale for such an assumption is that default is a low-probability event, so that it does not pay to seek information about λ before default is known to be impending. Indeed it can be shown that, even if they could, sophisticated investors would not engage in information collection at stage 1 if

$$\frac{1-p}{2}R < C, \tag{5}$$

where R is defined by (4) – that is, the expected value of the informational rent that they can hope to earn in the primary market falls short of the cost of information acquisition. Importantly, condition (5) does not prevent sophisticated investors from seeking the same information at stage 3, *once* they learn that default will occur. As we shall see, they will do so if $R/2 > C$: both conditions are satisfied for a large parameter region if the default probability $1 - p$ is small.

2.3 Private and Social Value of Liquidity

As we have seen, the investors who may seek liquidity on the secondary market are "discretionary liquidity traders": their demand for liquidity is not completely inelastic, because they can turn to an alternative source of liquidity at a private cost Δ. If the hypothetical discount at which the ABS would trade were to exceed Δ, these investors will refrain from liquidating their ABS. In this case, as explained above, they may resort to fire sales of other assets, default on a maturing debt and incur the implied reputational and judicial costs; or forgo other profitable investments, for instance by recalling loans to others.

However, each of these alternatives may entail costs for third parties too. For instance, if the ABS holder decides to generate liquidity by selling assets required for production, this may require also firing employees hired to work with these assets or canceling orders to suppliers of raw materials. If he instead defaults on his debts or recalls loans to his clients, he may force other lenders or borrowers into default, triggering a chain reaction due to their interlocking balance sheets. Insofar as secondary market liquidity spares these additional costs to society, its social value exceeds its private value.

For simplicity, we model the additional value of liquidity to third parties as $\gamma\Delta$, where $\gamma \geq 0$ measures the negative externality of secondary market illiquidity. Thus the total social value of liquidity is $(1 + \gamma)\Delta$, and the limiting case $\gamma = 0$ captures a situation where market liquidity generates no externalities.

3 Secondary Market Equilibrium

In this setting, what degree of ratings transparency will issuers choose? In this section we solve the model by backward induction. We start determining the secondary market equilibrium price at stage 3, conditional on either repayment or default: we first determine the market price depending on whether sophisticated investors decide whether to gather information and on whether liquidity traders decide whether to sell their ABS, both under transparency and under opaqueness. Then we turn to stage 2 and solve for the optimal decisions of these two classes of investors in both regimes. Finally we turn to stage 1, when issuers choose the information to be gathered and disclosed by the rating agency.

3.1 Secondary Market Price

In the good state G, the ABS is known to repay its face value 1, and therefore its secondary market price at time 3 is simply:

$$P_3^G = q_G.$$

The market is perfectly liquid: if hit by liquidity shocks, investors can sell the ABS at price P_3^G, and obviously collecting information about λ would be futile.

If the ABS is expected to be in default (in states B_1 or B_2), to determine the corresponding level of the ABS price P_3^B we must consider three cases, depending on the information made available to investors at stage 1 and on the sophisticated investors' decision to collect information.

In the transparent regime, investors and market makers learn the realization of λ. Since market makers are sophisticated, they interpret the rating and impound the relevant state prices in their secondary market quotes. The ABS's price at stage 3 is simply the expected value of the underlying portfolio conditional on default, which can be computed as the sum of the payoffs in B_1 and B_2 shown in Table 1, each of which occurs with probability 1/2 conditional on default occurring:

$$P_{3,T}^{B} = \frac{x}{2}\left[\lambda q_{B1} + (1-\lambda) q_{B2}\right],$$

where the subscript T indicates that this price refers to the transparent regime. In this case, the secondary market is perfectly liquid, as prices are fully revealing: liquidity traders have no transaction costs. In this case the market price is a random variable, whose value depends on the realization of λ (or equivalently of $\widetilde{\lambda}$) and on average is equal to:

$$E(P_{3,T}^{B}) = \frac{x}{2} q_B,$$

which is the unconditional ABS recovery value in the default states B_1 and B_2. So the secondary market price in the transparent regime can be rewritten as the sum of the expected ABS recovery value and a zero-mean innovation:

$$P_{3,T}^{B} = \frac{x}{2} q_B - \widetilde{\lambda}\frac{x}{2}(q_{B2} - q_{B1}). \tag{6}$$

In the opaque regime, whose price is subscripted with O, we need to distinguish between the subgame where sophisticated investors collect information on λ and that in which they elect not to. So we shall also subscript the secondary market price with I (for "informed trading") in the first case and N in the second (for "no informed trading"). In the latter subgame, all investors estimate λ at its expected value 1/2, so that ABS price at stage 3 is just its expected recovery value:

$$P_{3,O,N}^{B} = \frac{x}{2} q_B, \tag{7}$$

which is the average price in the transparent regime. In this case too, the secondary market is perfectly liquid, since there are no informational asymmetries between investors, and again liquidity traders have no transaction costs.

In the other subgame, where a fraction $\phi > 0$ of the sophisticated investors become informed, the secondary ABS market is characterized by asymmetric information: for the sophisticated investors who have been able to discover the true value of λ, the value of ABS is given by expression (6), while for all other investors the ABS value is given by expression (7). In the default states, the market maker will set the bid price $P^B_{3,O,I}$ so as to recover from the uninformed investors what he loses to the informed, as in Glosten and Milgrom (1985). Suppose that investors sell whenever they suffer a liquidity shock, which happens with probability π (we verify the validity of this assumption below). Informed investors (a fraction $\phi\mu$ of all investors) may sell even in the absence of a shock, if the bid price is above their estimate of the ABS value. Let us assume that this occurs if λ equals $\lambda_H = 1/2 + \sigma$, or equivalently $\widetilde{\lambda} = \sigma$, which occurs with probability 1/2. (Below we shall verify that this assumption is verified in equilibrium.) To avoid dissipating their informational rents, informed traders will camouflage as liquidity traders, placing orders of the same size. Hence, the frequency of an investor submitting a sell order is $\pi + \phi\mu(1-\pi)/2$. The market maker gains $(x/2)q_B - P^B_{3,O,I}$ when he trades with an uninformed investor, and loses $P^B_{3,O,I} - (x/2)\left[q_B - \sigma(q_{B2} - q_{B1})\right]$ when he trades with an informed one. Hence, his zero-profit condition is

$$\pi\left(\frac{x}{2}q_B - P^B_{3,O,I}\right) = (1-\pi)\frac{\phi\mu}{2}\left[P^B_{3,O,I} - \frac{x}{2}q_B + \sigma\left(q_{B2} - q_{B1}\right)\right],$$

and the implied equilibrium bid price is

$$\begin{aligned} P^B_{3,O,I} &= \frac{x}{2}q_B - \frac{(1-\pi)\phi\mu}{2\pi + (1-\pi)\phi\mu}\frac{\sigma x}{2}\left(q_{B2} - q_{B1}\right) \\ &= \frac{x}{2}q_B - \frac{(1-\pi)\phi\mu}{2\pi + (1-\pi)\phi\mu}R, \end{aligned} \tag{8}$$

where R is the rent that an informed trader extracts from an uninformed one (conditional on these both trading), from expression (4). The informed traders' rent R is weighted by the probability of a sell order being placed by an informed trader, $(1-\pi)\phi\mu/[2\pi + (1-\pi)\phi\mu]$. This expected rent translates into a discount sustained by liquidity traders in the secondary market: if hit by a liquidity shock, they must sell the ABS at a discount off the unconditional expectation of its final payoff.

3.2 Decision to Acquire Information

In the opaque regime, the sophisticated investors who are not hit by a liquidity shock at stage 2 may have the incentive to learn the realization of λ. The cost of learning λ with probability ϕ is $C\phi$. The gain from learning λ equals the market makers' expected trading loss as determined above:

$$P^B_{3,O,I} - \frac{x}{2}\left[q_B - \sigma\left(q_{B2} - q_{B1}\right)\right] = \frac{2\pi}{2\pi + (1-\pi)\phi\mu}R,$$

where in the second step the gain is evaluated at the equilibrium price in (8). This gain accrues to informed investors only if unsophisticated investors trade in the secondary market, and even then it is obtained with probability 1/2, since only when $\lambda = 1/2 + \sigma$ do informed investors make a profit by selling the ABS.[12] Hence, the expected profit from gathering information is:

$$\frac{\phi}{2}\frac{2\pi}{2\pi + (1-\pi)\phi\mu}R - C\phi.$$

Each sophisticated investor chooses whether to invest in information taking the benefit of information $\left(\frac{2\pi}{2\pi+(1-\pi)\phi\mu}R\right)$ as given. Assuming that in the aggregate sophisticated investors choose to gather information up to the point where these expected profits fall to zero, ϕ will be set at the level:

$$\phi^* = \max\left\{\frac{\pi}{\mu(1-\pi)}\left(\frac{R}{C} - 2\right), 0\right\}.$$

Therefore, sophisticated investors acquire information – that is, choose $\phi^* > 0$ – only if $R > 2C$.

Note that the sophisticated investors' decision to collect information is conditional on uninformed traders selling whenever they suffer a liquidity shock. But they will actually want to do so only if the discount does not exceed the reservation value Δ

[12] With the same probability, sophisticated investors learn that $\lambda = 1/2 + \sigma$. But this piece of information cannot be exploited by buying the CDO, since by assumption there are no liquidity buyers.

that they place on liquidity. Formally, they will sell if

$$\Delta \geq \frac{(1-\pi)\phi\mu}{2\pi + (1-\pi)\phi\mu} R. \tag{9}$$

When this constraint is satisfied, unsophisticated investors will participate in the secondary market even when it is not perfectly liquid. If, instead, constraint (9) is violated, unsophisticated investors will not trade, market makers will be unable to recoup their losses on trading with informed investors, and the market will freeze.

If $\phi^* > 0$, substituting it into equation (8) yields the stage-3 equilibrium price when the secondary market is illiquid, and replacing it in the uninformed investors' participation constraint (9), one finds that these investors participate if $\Delta \geq R - 2C$. Notice that when this condition is not met, the market for the security is inactive and the value of the portfolio to liquidity sellers is $\frac{x}{2}q_B - \Delta$, that is, its expected recovery value minus their reservation value of liquidity.

Summarizing, when default is expected at stage 3, the secondary market price will depend on the transparency regime chosen at stage 1 and on parameter values as follows:

$$P_3^B = \begin{cases} \frac{x}{2}q_B - \widetilde{\lambda}\frac{x}{2}(q_{B2} - q_{B1}) & \text{with transparency;} \\ \frac{x}{2}q_B & \text{with opaqueness, if } R \leq 2C; \\ \frac{x}{2}q_B - (R - 2C) & \text{with opaqueness, if } R \in (2C, 2C + \Delta]; \\ \text{none: market freeze} & \text{with opaqueness, if } R > 2C + \Delta. \end{cases} \tag{10}$$

Based on this result, we characterize the equilibrium secondary market outcome:

Proposition 1 *In the transparent regime, the secondary market is perfectly liquid. In the opaque regime, the secondary market is*

(i) perfectly liquid if the expected rent from informed trading is low: $R \leq 2C$;

(ii) illiquid if the expected rent from informed trading is at an intermediate level: $R \in (2C, 2C + \Delta]$;

(iii) inactive if the expected rent from informed trading is high: $R > 2C + \Delta$.

Therefore, the secondary market's ability to cater to liquidity sellers varies inversely with the rent that can be earned by informed investors. When the ABS sale was conducted opaquely and the rents from private information are high, default triggers illiquidity or market freeze.

4 Primary Market Price and Transparency Choice

With opaqueness, at the issue stage all investors share the same information, so that there is no underpricing due to adverse selection in the primary market. In contrast, with transparency sophisticated investors have an informational advantage in bidding for the ABS, so that unsophisticated investors participate only if the security sells at a discount.

4.1 Issue Price with Opaqueness

If the realization of λ is not disclosed, at stage 1 the two types of investors are on an equal footing in their valuation of the securities, so that the price is simply the unconditional risk-adjusted expectation of the ABS payoff, $pq_G + (1-p)xq_B/2$, net of the expected stage-3 liquidity costs:

$$P_{1,O} = \begin{cases} pq_G + (1-p)\frac{x}{2}q_B & \text{if } R \leq 2C; \\ pq_G + (1-p)\left[\frac{x}{2}q_B - \pi(R-2C)\right] & \text{if } R \in (2C, 2C+\Delta]; \\ pq_G + (1-p)\left(\frac{x}{2}q_B - \pi\Delta\right) & \text{if } R > 2C+\Delta. \end{cases} \tag{11}$$

4.2 Issue Price with Transparency

With transparency, the equilibrium price in the primary market is such that unsophisticated investors value the asset correctly in expectation, conditional on their information and on the probability of their bids being successful:

$$P_{1,T} = \xi V(\lambda_L) + (1-\xi)V(\lambda_H), \tag{12}$$

where ξ is the probability that unsophisticated investors successfully bid for a low-risk ABS, if sophisticated investors play their optimal bidding strategy, and V is the risk-adjusted PDV of the security conditional on the realization of λ.

Recalling that at stage 1 the ABS is allocated to investors via a uniform price auction, the probability ξ with which unsophisticated investors secure a low-risk ABS depends on the bidding strategy of informed investors, which in turn depends on the realization of λ. To see this, consider that for sophisticated investors the value of the ABS is given by expression (2), so that they are willing to bid and pay a price $P > V_T(\lambda)$ if $\lambda = \lambda_L$ (i.e. $\widetilde{\lambda} = -\sigma$) but they place no bids if $\lambda = \lambda_H$ (i.e. $\widetilde{\lambda} = \sigma$). As a result, if $\widetilde{\lambda} = -\sigma$ both types of investor bid: the sophisticated investors get a share of the portfolio with probability μ and the unsophisticated get it with probability $1 - \mu$. If $\widetilde{\lambda} = \sigma$, instead, unsophisticated investors get a share of the portfolio with certainty.

Thus the probability of an unsophisticated investor's buying the ABS if $\widetilde{\lambda} = -\sigma$ is $\xi = (1 - \mu)/(2 - \mu) < 1/2$ and, using equation (12), the issue price is

$$P_{1,T} = pq_G + (1 - p)\left(\frac{x}{2}q_B - \frac{\mu}{2 - \mu}R\right), \tag{13}$$

where $(1 - p)\mu R/(2 - \mu)$ is the discount required by unsophisticated traders to compensate for their winner's curse. This price is increasing in the fraction of sophisticated investors μ and in their informational rent R, as both these parameters tend to exacerbate adverse selection in the primary market. So with transparency there is no discount due to secondary market illiquidity, but there is underpricing arising from adverse selection in the primary market.

4.3 Face Value of the ABS

The expressions (11) and (13) for the issue price are predicated on the assumption that the issuer sets the face value of the ABS equal to its payoff in the good state, that is, $F = 1$. Clearly, choosing a lower value for F would lower the first term of both expressions, since it would imply that only a fraction of the good-state payoff would be pledged to the ABS. Since the issuer invests any proceeds from the sale of the ABS at a net return $r > 0$, he wants to choose F so as to maximize the issue price. Hence, he will set $F = 1$ independently of the choice of transparency (to be analyzed in the next section). This verifies the original assumption made in Section 2.1 about the face value of the ABS.

4.4 The Crisis

It is interesting to consider what happens to prices as the economy moves from stage 1 to stage 3, that is, as it becomes known whether the ABS will repay its face value or not, and how the outcome is affected by the degree of transparency of the initial sale.

If at stage 3 it becomes apparent that the ABS will repay its face value, the price rises from $P_{1,T}$ in (13) or $P_{1,O}$ (11) to $P_3^G = q_G$, as the discount due to default risk vanishes, and the secondary market is perfectly liquid.

If instead default is announced at stage 3, the market price will obviously fall below the issue price, but the outcome will be very different depending on the transparency regime and on the value of informational rents R, as shown by expression (10). Under transparency, the price will fall to the new risk-adjusted PDV $(x/2)\left[q_B - \widetilde{\lambda}(q_{B2} - q_{B1})\right]$, but the market will stay liquid. On average, the change in the market price will be

$$\mathrm{E}(P_{3,T}^B) - P_{1,T} = -p\left(q_G - \frac{x}{2}q_B\right) + (1-p)\frac{\mu}{2-\mu}R. \tag{14}$$

This expression shows that the revision in fundamentals following the bad news about the ABS default (the first term) is partially cushioned by its initial underpricing (the second term).

Under opaqueness, instead, the price drop following the announcement of default is steeper. This is for two reasons. First, even if the market stays liquid because informational rents are low ($R \leq 2C$), now the revision in fundamentals is not cushioned by the initial underpricing. Second, if informational rents are larger (in the interval $(2C, 2C+\Delta]$), then the ABS price drops further due to the illiquidity of the market: as informed investors start trading, market makers will protect themselves by posting a lower bid price:

$$P^B_{3,O} - P_{1,T} = \begin{cases} -p\left(q_G - \frac{x}{2}q_B\right) & \text{if } R \leq 2C; \\ -p\left(q_G - \frac{x}{2}q_B\right) - [1-(1-p)\pi](R-2C) & \text{if } R \in (2C, 2C+\Delta]; \\ \text{cannot be computed: market freeze} & \text{if } R > 2C+\Delta. \end{cases} \tag{15}$$

Finally, if informational rents are so large as to exceed even $2C + \Delta$, the market for ABS freezes: the price at which market makers would be willing to buy is so low that would-be sellers prefer to resort to fire-sales of other assets or anyway refrain from trading their ABS.

The second and third line of (15) indicate that if informational rents are sufficiently high, the announcement of the ABS default can trigger a market crash and the transition from a liquid primary market to an illiquid or frozen secondary market. This is what Gorton (2009) describes as a "panic", that is, a situation in which structured debt securities turn from being informationally insensitive to informationally sensitive, and "some agents are willing to spend resources to learn private information to speculate on the value of these securities. This was not profitable before the panic... This makes them illiquid." (p. 36-37). It is worth underscoring that this steep price decline and drying up of liquidity would not occur if the initial sale were conducted in a transparent fashion.

The financial crisis of 2007-08 featured first a drop in ABS prices and then a market freeze. In our model, this would occur in the opaque regime if the rents from informed trading were to rise over time, moving the economy first into the illiquidity region and then into the market freeze region. This increase in R may arise from an increase in the variability of the risk sensitivity of ABS (σ), in the discrepancy between the marginal value of consumption in the two default states ($q_{B2} - q_{B1}$), or from both: in other words, greater uncertainty about the quality of ABS, the gravity of the recession, or both.

4.5 Choice of Transparency

Which regime will the issuer choose to maximize the issue price? The answer boils down to comparing expressions (11) and (13), and is best understood graphically. Figure 2 illustrates how the issuer's optimal choice depends on the parameters of the model. The probability of the liquidity shock π is measured along the horizontal axis, the informational rent in the secondary market R along the vertical axis. In the lowest region where $R \leq 2C$, the issuer will choose opaqueness. As the profits from information do not compensate for the cost of its collection, the secondary market is perfectly liquid. Hence, the issuer's only concern is to avoid underpricing in the primary market, which is achieved by choosing opaqueness.

In the intermediate region where $R \in (2C, 2C + \Delta]$, the discount associated with transparency is $\mu R/(2 - \mu)$, whereas the discount with opaqueness is $\pi(R - 2C)$. Hence, the regime with opaqueness dominates if $R\left(\pi - \frac{\mu}{2-\mu}\right) < 2\pi C$. This condition is always met if $\pi < \frac{\mu}{2-\mu}\frac{\Delta+2C}{\Delta}$. In this parameter region, consequently, issuers will go for opaqueness if the probability π of investors requiring liquidity and their reservation value of liquidity Δ are low, and/or when there is severe adverse selection in the primary market (i.e. when the proportion μ of sophisticated investors is relatively large). Intuitively, if there is little demand for secondary market liquidity and/or adverse selection seriously impedes primary market liquidity, issuers concentrate on avoiding underpricing in the primary market. So they will choose opaqueness at the cost of sacrificing liquidity down the road. If this condition is not met, i.e. if $\pi > \frac{\mu}{2-\mu}\frac{\Delta+2C}{\Delta}$, the choice about disclosure also depends on the magnitude of the informational rent R: since the liquidity discount is increasing both in the probability of liquidation π and in the magnitude of the loss to informed traders R, opaqueness will be chosen only if a higher π is offset by a lower R. Graphically, we must stay to the left of the curved locus $R = 2\pi C/[\pi(2-\mu) - \mu]$.

In the top region where $R > 2C + \Delta$, if there is opaqueness at the issue stage, the secondary market freezes. So the issuer will bear the expected liquidity cost $\pi\Delta$, while saving the underpricing cost $\frac{\mu}{2-\mu}R$. Hence opaqueness is preferred if $\pi\Delta < \frac{\mu}{2-\mu}R$, that is, in the area to the left of the upward-sloping line $R = \pi(2-\mu)\Delta/\mu$; to its right, transparency is preferred. Therefore, as in the intermediate region, here too issuers choose opaqueness if π and Δ are low and/or μ is high, that is, if there is low demand for secondary market liquidity and/or transparency were to imply substantial primary market underpricing.

In conclusion, transparency is optimal in the shaded region of Figure 2 where the probability of the liquidity shock is sufficiently great. This shaded region vanishes if $(2-\mu)\pi\Delta < \mu(\Delta + 2C)$, since in this case the downward-sloping curve lies above the horizontal line $2C + \Delta$: if π and Δ are sufficiently small and/or μ sufficiently large, issuers never choose transparent ratings. Conversely, a transparency region always exists if the abscissa of its leftmost point A, $\pi = \frac{\mu}{2-\mu}\frac{2C+\Delta}{\Delta}$, is strictly smaller than 1, which is equivalent to the condition $\Delta/C > \mu/(1-\mu)$. In line with our previous results, this condition is more likely to be met, the larger the reservation price of liquidity Δ and the smaller the fraction of informed traders μ, but it is also more likely to be met if the cost C of gathering private information is low, so that adverse selection in the secondary market is expected to be severe.

These results are summarized in the following:

Proposition 2 *Issuers choose transparency in the region* $R \in [\frac{2\pi C(2-\mu)}{\pi(2-\mu)-\mu}, \frac{\pi\Delta(2-\mu)}{\mu}]$, *whose magnitude is increasing in the probability of liquidation* π *and in the reservation value of liquidity* Δ, *and is decreasing in the fraction of sophisticated investors* μ *and in their information gathering costs* C. *This region is non-empty if and only if* $\Delta/C > \mu/(1-\mu)$.

Based on the issuer's optimal choice of transparency, we can now write the expression for the equilibrium ABS price in the primary market, where for brevity we replace the unconditional risk-adjusted expectation of the ABS payoff $pq_G + \frac{1-p}{2}xq_B$ with V_O, recalling expression (1):

$$P_1 = \begin{cases} V_O & \text{if } R \leq 2C, \\ V_O - (1-p)\pi(R-2C) & \text{if } R \in (2C, \min\{2C+\Delta, \frac{2\pi C(2-\mu)}{\pi(2-\mu)-\mu}\}], \\ V_O - (1-p)\frac{\mu}{2-\mu}R & \text{if } R \in [\frac{2\pi C(2-\mu)}{\pi(2-\mu)-\mu}, \frac{\pi\Delta(2-\mu)}{\mu}], \\ V_O - (1-p)\pi\Delta & \text{if } R > \max\{2C+\Delta, \frac{\pi\Delta(2-\mu)}{\mu}\}. \end{cases} \tag{16}$$

In (16), only the third expression corresponds to the transparent regime, where the price contains a discount for the winner's curse problem in the primary market. The other three expressions show that the implications of opaqueness for issue prices differ greatly depending on the parameter region: no discount (top line), a discount due to low secondary market liquidity (second line) or an even deeper discount arising from secondary market freezing (bottom line).

5 Public Policy

The shadow value of liquidity to society may exceed the private value Δ placed on liquidity by distressed investors. As we saw in Section 2.3, this point is captured by denoting the social value of stage-3 liquidity as $(1+\gamma)\Delta$, where γ measures the intensity of the liquidity externalities. This creates the potential for welfare-enhancing public policies, which can take the form of mandatory transparency on the primary market or else of an intervention aimed at reviving an illiquid secondary market. This intervention can in turn take two forms: it can be targeted to investors hit by the liquidity shock or aimed at supporting the price on the ABS market. In this section we illustrate the effects of these interventions on transparency and social welfare.

5.1 Mandating Transparency

Suppose the government can mandate transparency at the issue stage: in which parameter regions is this socially efficient? The first step in answering is to define social welfare. Recall that the capital raised by the issuer is invested in some profitable new undertaking, producing a net return $r > 0$. Hence, the proceeds from securitization P_1 enter the social welfare weighted by r.

With transparency, social welfare is

$$W = r[V_O - (1-p)\frac{\mu}{2-\mu}R], \tag{17}$$

showing that in this regime inefficiency only arises from adverse selection in the primary market (captured by the second term). With opaqueness, welfare is

$$W = \begin{cases} rV_O & \text{if } R \leq 2C; \\ r[V_O - (1-p)\pi(R-2C)] & \text{if } R \in (2C, 2C+\Delta]; \\ r[V_O - (1-p)\pi\Delta] - (1-p)\pi\gamma\Delta & \text{if } R > 2C+\Delta, \end{cases} \tag{18}$$

showing that inefficiencies (may) arise from adverse selection in the secondary market (in the second and third expressions).

The socially optimal choice depends on the comparison between expressions (17) and (18). This is best done by comparing Figures 2 and 3: the only difference from the private choice of transparency characterized by Proposition 2 is found in the top region ($R > 2C + \Delta$), where the secondary market freezes if there is opaqueness, so that the issuer will sustain the expected liquidity cost $r\pi\Delta$ but save the underpricing cost $r\frac{\mu}{2-\mu}R$. However, the secondary market freeze generates an additional social cost due to the negative externality $\gamma\pi\Delta$.

Figure 3 shows that the area where transparency is socially optimal is larger than that where it is privately optimal. Within the top region where opaqueness triggers a secondary market freeze, transparency is socially – though not necessarily privately – preferred whenever $(r+\gamma)\pi\Delta > r\frac{\mu}{2-\mu}R$, that is, to the right of the upward-sloping line $R = \pi\Delta(r+\gamma)(2-\mu)/(r\mu)$. In other words, transparency is welfare-enhancing if secondary market liquidity has a great social value (high γ, π and Δ) and/or the supply of primary market liquidity is not severely impaired by transparent ratings (low μ and R). Conversely, when the opposite conditions obtain, opaqueness is preferred both privately and socially: if $(r+\gamma)\pi\Delta < r\frac{\mu}{2-\mu}R$, requiring transparent ratings would be detrimental.

The interesting case arises in the dark grey region defined by the condition that $R \in (\frac{\pi\Delta(2-\mu)}{\mu}, \frac{(r+\gamma)\pi\Delta(2-\mu)}{r\mu}]$. There, transparency is socially efficient but privately inefficient. Intuitively, in this area issuers see the underpricing in the primary market as costlier than the expected liquidity cost borne by investors (so opaqueness is privately optimal) but less costly than the social harm of market freezing (so transparency is socially optimal). In this area, making disclosure mandatory is welfare enhancing. To summarize:

Proposition 3 *Mandating transparency increases welfare if (and only if) (i) the secondary market would otherwise be inactive ($R > 2C + \Delta$) and (ii) the condition $R \in (\frac{\pi\Delta(2-\mu)}{\mu}, \frac{(r+\gamma)\pi\Delta(2-\mu)}{r\mu}]$ is satisfied.*

Mandating transparency is not the only public policy that can address the inefficiency arising from the lack of transparency. Another type of effective policy would be for the government to precommit to gathering and disseminating information about the ABS's risk sensitivity λ at the stage of secondary market trading. This would enable issuers to reap the benefits from opaqueness on the primary market while avoiding the attendant costs in terms of secondary market illiquidity. In principle, issuers themselves may wish to commit to such a delayed transparency policy, but such a promise may not be credible on their part: ex post they may actually have the incentive to reveal their information about λ to a sophisticated investor so as to share into his informational rents from secondary market trading.

5.2 Liquidity Provision to Distressed Investors

An alternative form of policy intervention is to relieve the liquidity shortage when the secondary market freezes at $t = 3$. Assuming that the market freeze forces ABS holders hit by the liquidity shock to sell other assets at the "fire sale" discount Δ, the government may target liquidity $L \leq \Delta$ to these distressed investors, for instance by purchasing their assets at a discount $\Delta - L$ rather than Δ. In the limiting case $L = \Delta$, it would make their assets perfectly liquid. Alternatively, the government may acquire stakes in the equity of distressed ABS holders and thereby reduce the need for fire sales of assets. In either case, the liquidity injection reduces the reservation value of liquidity from Δ to $\Delta - L$. This has a social cost $\tau L^2/2$, where the parameter $\tau > 0$ captures the cost of the distortionary taxes needed to finance the added liquidity.

This modification of the model has two important consequences. First, the expectation of the liquidity injection may distort the choice of transparency *ex ante*: anticipating that the demand for liquidity will be satisfied to some extent by public intervention, issuers will be less concerned over secondary market liquidity. Second, the liquidity injection affects welfare, so it becomes important to determine its optimal size.

We start with the effect on the choice of transparency. This is easily determined by replacing the reservation value of liquidity Δ with $\Delta - L$ in Proposition 2: now transparency is optimal in the region $R \in [\frac{2\pi C(2-\mu)}{\pi(2-\mu)-\mu}, \frac{\pi(\Delta-L)(2-\mu)}{\mu}]$, whose area is decreasing in L and vanishes for $L < \Delta - C\mu/(1-\mu)$. The reduction of the transparency area is illustrated in Figure 4. With $L > 0$, transparency is only chosen in the dark-grey area, while if $L = 0$ (as in Proposition 2) it is also chosen in the light-grey area. In this area, the liquidity injection induces the issuer to choose opaqueness because it lowers the reservation value of liquidity compared with Proposition 2. Formally, the injection changes the issuer's indifference condition between opaqueness and transparency to the locus $R = \pi(\Delta - L)(2 - \mu)/\mu$, which is flatter than the corresponding line in Figure 2.

The liquidity injection also expands the area in which the secondary market freezes compared with Figure 2: the relevant condition is now $R > 2C + \Delta - L$, so that the horizontal line above which the freeze occurs shifts downward, as illustrated in Figure 4. Precisely because the intervention reduces the cost of generating liquidity outside the ABS market, liquidity traders will shun the market in a wider range of circumstances. This result, together with the reduced incentives to issuers for transparency, indicates that the liquidity injection, though beneficial *ex post*, may have perverse effects *ex ante*.

This leads us to the second question: how large should be the liquidity injection L planned in case of market freeze? With transparency, there is no role for liquidity provision as the market is perfectly liquid. The same is true if transparency is low but $R \leq 2C + \Delta - L$, so that the market operates, albeit possibly with low liquidity. Therefore, the only relevant case is a complete market freeze, which occurs if $R > 2C + \Delta - L$. In this region, social welfare has three components: (i) the net value of the ABS, $r[V_O - \pi(1-p)(\Delta - L)]$; (ii) the negative externality $-\gamma\pi(1-p)(\Delta - L)$; and (iii) the expected cost of distortionary taxation $-\tau\pi(1-p)L^2/2$. Therefore, social welfare is

$$W = r[V_O - \pi(1-p)(\Delta - L)] - \gamma\pi(1-p)(\Delta - L) - \tau\pi(1-p)L^2/2$$

and the liquidity provider chooses $L \in [0, \Delta]$ to maximize W. Maximizing this expression with respect to L, the optimal liquidity injection is found to be $L^* = \min\left((r+\gamma)/\tau, \Delta\right)$. So if it is not set at the corner solution Δ, which eliminates the "fire sale" discount Δ altogether, the optimal liquidity injection is increasing in the profitability of the proceeds from the ABS sale (r) and in the liquidity externality (γ) and decreasing in the marginal cost of taxes (τ).

If the government can precommit to this optimal liquidity provision, and if issuers and investors have rational expectations, we can replace L^* in the condition that defines the upper bound of the transparency region, yielding $R < \pi\left[\Delta - \min\left((r+\gamma)/\tau, \Delta\right)\right](2-\mu)/\mu$. This condition is never satisfied when the optimal liquidity injection is at its maximal level Δ, implying that in this case the transparency region disappears. But even when the optimal injection is an internal optimum $L^* = (r+\gamma)/\tau < \Delta$, the transparency region $R \in \left[\frac{2\pi C(2-\mu)}{\pi(2-\mu)-\mu}, \frac{\pi(\Delta-L^*)(2-\mu)}{\mu}\right]$ is non-empty only if the liquidity injection satisfies the more binding constraint $L^* < \Delta - C\mu/[\pi(2-\mu)-\mu]$. The following proposition summarizes these results:

Proposition 4 *If expected, public liquidity provision to the investors in need of liquidity reduces the magnitude of the transparency region and increases that of the market freeze region. The optimal liquidity injection is* $L^* = \min\left((r+\gamma)/\tau, \Delta\right)$ *and is consistent with transparency if and only if it does not exceed* $\Delta - C\mu/[\pi(2-\mu)-\mu]$.

5.3 Public Intervention in the ABS Market

In the previous section, the government was assumed to target the liquidity injection to the investors hit by a liquidity shock, since it can identify the degree of their distress. Alternatively, the government may intervene to support the market for ABS without targeting liquidity sellers, either by replacing the market makers or subsidizing them. This was the main feature of the initial version of Paulson plan in the U.S., which envisaged "reverse auctions" aimed at buying back securitized loans from banks – a plan later replaced by an approach targeted at recapitalizing distressed banks, and thus closer to the intervention described in the previous section. However, in July 2009 the Federal Reserve has started engaging in forms of indirect support of the ABS market, by providing cheap loans to investors such hedge funds for the purchase of commercial MBS. In this section, we consider what would be the effect of such public intervention in the ABS market.

The only change in the model occurs in the opaque regime. With a government subsidy L, market makers can now incur a loss when informed trading occurs. Hence, in case of default, they set a higher price than in the basic model in Section 4:

$$P^B_{3,O,I} = L + \frac{x}{2}q_B - \frac{(1-\pi)\phi\mu}{2\pi + (1-\pi)\phi\mu}R$$

The difference from Section 4 is the subsidy L that is now transferred to investors selling in the secondary market. This may relieve investors hit by a liquidity shock but also increases the incentives of sophisticated investors to acquire information. The total effect of this policy depends on the balance between these effects.

First, the investors hit by a liquidity shock will be more likely to sell in the secondary market. They will do so if:

$$\Delta \geq \frac{(1-\pi)\phi\mu R}{2\pi + (1-\pi)\phi\mu} - L.$$

Second, the expected profit from gathering information is now larger:

$$\frac{\phi}{2}[L + \frac{2\pi}{2\pi + \phi\mu(1-\pi)}R] - C\phi.$$

Assuming as before that in the aggregate sophisticated investors gather information up to the point where these expected profits are zero, ϕ will be set at the level:

$$\phi^* = \max\left\{\frac{2\pi(R+L-2C)}{(1-\pi)\mu(2C-L)}, 0\right\}.$$

Therefore, the greater is L, the more likely sophisticated investors are to acquire information.

Replacing ϕ^* into the participation constraint for investors hit by a liquidity shock, we find that these investors participate if $\Delta \geq R + L - 2C - L = R - 2C$. This equation is identical to the one in Section 4. So the price in the secondary market in case of default is unchanged at $P^B_{3,O,I} = \frac{x}{2}q_B - (R - 2C)$.

Therefore injecting liquidity by supporting the market for ABS has no effect on the equilibrium: namely, there is no change in the size of the area where the market freezes. The only consequence is an increase in the investment in information by the sophisticated investors. Intuitively, the liquidity injection is entirely absorbed by heigthened informed trading, so that in equilibrium none of it reaches the liquidity traders whose distress it was intended to alleviate. Hence, if the public funds needed to provide liquidity L are raised via distortionary taxes, we can conclude that:

Proposition 5 *Providing liquidity in the market for ABS is socially inefficient.*

6 Extensions

In the analysis so far, issuers have been assumed to securitize and sell a given portfolio. In this section, we explore how the results are modified if issuers are allowed to choose the size of the portfolio to be securitized, or to split it into two securities of different risk, a practice known as "tranching".

These extensions change the model in a critical way. The basic tradeoff between the liquidity of the primary and secondary markets exists only because the sophisticated investors are not numerous and wealthy enough to buy the entire ABS issue. Because of this assumption, uninformed investors must be drawn into the primary market. As these investors cannot price information about λ, transparency comes at the cost of adverse selection in the primary market.

Reducing or tranching the issue are two ways to alleviate the dearth of sophisticated capital. A large enough reduction in issue size eliminates the need for unsophisticated investors, and thus the illiquidity cost of transparency, albeit at the cost of less revenue. Issuers can do even better by tranching the issue, creating two securities with different sensitivity to complex information, so as to induce sophisticated investors alone to buy the more information-sensitive tranche and the unsophisticated to invest in the safe one. They can thus go for transparency without reducing the total size of the issue, provided sophisticated investors are wealthy enough as to absorb the entire information-sensitive tranche.

6.1 Reducing the Issue Size

Consider an issuer who at the beginning of stage 1 can proportionately scale down the portfolio of credits that he wishes to securitize. To reduce the number of possible cases, we assume here that $\Delta/C < \mu/(1-\mu)$, so that without restricting issuance the issuer would always opt for opaqueness in equilibrium, based on Proposition 2. We show instead that when the issue size is suitably reduced, under certain parameter restrictions the issuer may opt for transparency. The question then is whether the issuer will ever find it worthwhile to bear the cost associated with a smaller issue.

Suppose that instead of selling the entire portfolio, the issuer can sell a fraction $s \in [0,1]$, thus rescaling both the ABS's face value F from 1 to s and its payoff to a fraction s of the original amount. Recall that sophisticated investors are assumed to be unable to buy the entire issue in both states of nature, i.e. $A_S < V_T(\lambda_L)$. But if the issuer can rescale, he can choose to sell a fraction s such that sophisticated investors can buy it entirely, that is, $s \leq A_S/V_T(\lambda_L)$. In this case, there is no loss in disclosing λ, and the issue will sell (fractionally) at its correct value $V_T(\lambda) = V_O - \frac{1-p}{2}x\widetilde{\lambda}(q_{B2} - q_{B1})$. Therefore, the maximum fraction that can be sold to sophisticated investors alone is:

$$\overline{s} = \frac{A_S}{V_O + \frac{1-p}{2}x\sigma(q_{B2} - q_{B1})} = \frac{A_S}{V_O + (1-p)R}, \tag{19}$$

where in the second step we use definition (4). Notice that $\overline{s} < 1$ because by assumption $A_S < V_O + (1-p)R$.

Since the issuer does not know q_{B1} and q_{B2}, his decision to scale down the issue to $\overline{s}$ must be based on the unconditional expectation of $V_T(\lambda)$, that is, V_O. Therefore, when scaling down the issue size, the expected proceeds are:

$$P_{1,T}^{\overline{s}} = \overline{s}V_O = \frac{A_S}{V_O + (1-p)R}V_O. \tag{20}$$

If the issuer chooses to scale down the ABS to $\overline{s}$, he will also choose transparency, as explained before. Alternatively, the issuer can sell the entire issue, that is, set $s = 1$, and opt for opaqueness, given our assumption $\Delta/C < \mu/(1-\mu)$. In this case, the revenue from securitization will be:

$$P_{1,O} = \begin{cases} V_O & \text{if } R \leq 2C \\ V_O - (1-p)\pi(R - 2C) & \text{if } R \in (2C, 2C + \Delta] \\ V_O - (1-p)\pi\Delta & \text{if } R > 2C + \Delta \end{cases}. \tag{21}$$

The choice turns on a comparison between $P_{1,O}$ and $P_{1,T}^{\overline{s}}$, which depends critically on the wealth of the sophisticated investors. To see this, consider that the revenue $P_{1,T}^{\overline{s}}$ from the restrained sale is directly proportional to A_S. Accordingly, there is a threshold wealth level $\overline{A}$ below which scaling down the ABS issue is not worthwhile. This can be obtained by comparing the revenue from scaling down the ABS issue, $\overline{s}V_O$, with the minimum revenue from a full-scale issue under opaqueness, which is the value that $P_{1,O}$ reaches for $\pi = 1$ and $R = 2C + \Delta$. This threshold wealth level for A_S, below which restricting the issue size is not revenue-increasing, is

$$\overline{A} = [V_O + (1-p)(2C + \Delta)] \left[1 - (1-p)\frac{\Delta}{V_O}\right]. \tag{22}$$

The condition $A_S > \overline{A}$ is necessary for the smaller sale to be revenue-increasing, but not sufficient. Additional parameter restrictions must be met, as shown in Figure 5: choosing $s = \overline{s}$ and transparency is revenue-increasing for the issuer only in the grey area below the concave and above the convex curve. If $A_S > \overline{A}$, then the two curves intersect when the probability of liquidation π is less than 1, so that the region is non-empty. But to be in the grey area, it is also necessary that, for any given R, the value of liquidation probability π is high enough. Specifically, for $R \in (2C, 2C + \Delta)$, which defines the region of market illiquidity if $s = 1$, issuers will opt for $s = \overline{s}$ and transparency only if π exceeds $(1 - \overline{s})V_O/[(1 - p)(R - 2C)]$. And for $R > 2C + \Delta$, which defines the region of market freeze if $s = 1$, they do so only if π exceeds $(1-\overline{s})V_O/[(1-p)\Delta]$. In both cases, the rationale is clear: by curtailing issuance and choosing transparency, the issuer makes the market liquid when it would otherwise be illiquid or inactive, and this is profitable only if traders are sufficiently likely to liquidate the ABS, that is, if the demand for liquidity is high enough.

These results, proved in the Appendix, are summarized in the following:

Proposition 6 *Reducing the size of the issue is never optimal if the wealth of sophisticated investors A_S is lower than the threshold $\overline{A}$, defined in (22). Otherwise, it is optimal to reduce the size of the issue to $\overline{s} = A_S/[V_O + (1-p)R] < 1$ and to choose transparency if: (i) $\pi > (1 - \overline{s})V_O/[(1 - p)(R - 2C)]$ for $R \in [2C, 2C + \Delta)$ or (ii) $\pi > (1 - \overline{s})V_O/[(1 - p)\Delta]$ for $R > 2C + \Delta$.*

6.2 Tranching

Beside reducing the size of the ABS placed on the market, the issuer can split the ABS issue into two tranches: senior claims S with face value F^S and junior claims J with face value F^J. In case of default, senior claims will be paid first and in total before junior claims are paid. The former claims are sold at the issue price P_1^S, the latter at P_1^J. As shown by Gorton and Pennacchi (1990) and Plantin (2004), tranching allows the issuer to raise the total proceeds by selling the junior and information-sensitive tranche to sophisticated investors, and the senior and less information-sensitive one to unsophisticated investors. By segmenting the market in this fashion, the issuer eliminates (or reduces) the adverse selection costs stemming from the pooling of the two groups of investors.

In the context of the example of the previous section, we will show that not only tranching increases the proceeds from the ABS issue but also expands the region where transparency is privately optimal. Intuitively, this is because it reduces the size of the portfolio that must be sold to sophisticated investors so as to avoid adverse selection costs: with tranching, sophisticated investors must be wealthy enough as to absorb only the junior tranche, or at least a sufficiently large portion of it, for transparency to be optimal.

To see this, suppose that the senior tranche is completely safe. From Table 2, we notice that this security pays at most $(1/2 - \sigma)\,x$ in each state of the world. Hence, the issuer can sell a senior claim with face value $F^S = (1/2 - \sigma)\,x$, whose PDV is $V^S = [pq_G + (1-p)(q_{B1} + q_{B2})/2]\,(1/2 - \sigma)\,x = (1/2 - \sigma)\,x$, recalling that by assumption $pq_G + (1-p)(q_{B1} + q_{B2})/2 = 1$ The issuer will also sell a junior claim with face value $F^J = 1 - (1/2 - \sigma)\,x$, whose payoffs are shown in Table 3.

Table 3. Junior Tranche Payoffs

State	Probability	Junior tranche payoff	State price
G, $\lambda = \lambda_H$	$\frac{p}{2}$	$1 - \left(\frac{1}{2} - \sigma\right) x$	$\frac{p}{2} q_G$
B_1, $\lambda = \lambda_H$	$\frac{1-p}{4}$	$2\sigma x$	$\frac{1-p}{4} q_{B1}$
B_2, $\lambda = \lambda_H$	$\frac{1-p}{4}$	0	$\frac{1-p}{4} q_{B2}$
G, $\lambda = \lambda_L$	$\frac{p}{2}$	$1 - \left(\frac{1}{2} - \sigma\right) x$	$\frac{p}{2} q_G$
B_1, $\lambda = \lambda_L$	$\frac{1-p}{4}$	0	$\frac{1-p}{4} q_{B1}$
B_2, $\lambda = \lambda_L$	$\frac{1-p}{4}$	$2\sigma x$	$\frac{1-p}{4} q_{B2}$

The value of the junior tranche is the difference between the value of the untranched ABS and that of the senior tranche:

$$V^J(\lambda) = V_T(\lambda) - V_T^S = V_O - \frac{1-p}{2} x \widetilde{\lambda}(q_{B2} - q_{B1}) - \left(\frac{1}{2} - \sigma\right) x.$$

For this to be the market price of the junior tranche, sophisticated investors must be wealthy enough to be able to buy it entirely. This requires their wealth A_S to be at least equal to $V^J(\lambda_L)$, the largest possible value of the junior tranche, that is:

$$\begin{aligned} A_S &\geq V^J(\lambda_L) = V_O + \frac{1-p}{2} x\sigma(q_{B2} - q_{B1}) - \left(\frac{1}{2} - \sigma\right) x \\ &= V_O + (1-p)R - \left(\frac{1}{2} - \sigma\right) x. \end{aligned} \tag{23}$$

If this condition holds, tranching is profitable if combined with transparency, since investors will sort themselves into the two markets according to their degree of sophistication and the two securities will be sold with no discount.[13] Sophisticated investors will buy the junior security to exploit their superior pricing ability, and competition between them ensures that this tranche sells at $P^J = V^J(\lambda)$, with no discount. At this price, unsophisticated investors will have no incentive to purchase the junior tranche and will instead self-select into the market for the senior tranche

[13] We make the following tie-breaking assumption: when indifferent, sophisticated investors choose to invest in the riskier claim, whereas unsophisticated ones choose the safe claim.

where they suffer no informational disadvantage. Hence, the issuer avoids a tradeoff in the transparency choice: if sophisticated investors are wealthy enough, issuers choose transparency and tranching, and the entire portfolio is correctly priced without a liquidity discount. This outcome is both privately and socially efficient.

If condition (23) is not met, tranching still enables the issuer to sell the senior tranche at its full value, but the trade-off between opaqueness and transparency reappears concerning the sale of the junior tranche. As in Section 5.1, to reduce the number of possible cases, we assume that $\Delta/C < \mu/(1-\mu)$, so that without tranching the issuer would always opt for opaqueness in equilibrium, based on Proposition 2.

With opaqueness, the proceeds from the sale of the junior tranche will be:

$$P_{1,O}^{J} = \begin{cases} V_O - \left(\frac{1}{2} - \sigma\right) x \equiv V_O^J & \text{if } R \leq 2C \\ V_O^J - (1-p)\pi(R-2C) & \text{if } R \in (2C, 2C+\Delta] \\ V_O^J - (1-p)\pi\Delta & \text{if } R > 2C+\Delta \end{cases} . \tag{24}$$

Notice that since the senior tranche is safe, tranching transfers all asymmetric information problems onto the junior claim.

With transparency, the issuer can at most sell a fraction $\overline{s}^J \equiv A_S/V^J(\lambda_L)$ of the risky tranche at zero discount to the sophisticated and retain the rest for himself. Clearly, the maximum fraction of the risky tranche that can be sold to sophisticated investors exceeds the maximum fraction of the entire ABS issue that they can absorb, as defined by (19), that is, $\overline{s}^J > \overline{s}$. Thus, the revenue from auctioning the junior tranche to sophisticated investors alone under transparency is a fraction $\overline{s}^J$ of the expected value of the junior tranche, V_O^J, with no adverse selection discount:

$$P_{1,T}^{J} = \overline{s}^J V_O^J. \tag{25}$$

The choice between transparency and opaqueness depends on the comparison between $P_{1,O}^J$ and $P_{1,T}^J$. Building on the proof of Proposition 6, one can show that:

Proposition 7 *For the issuer it is optimal to choose transparency and issue a senior tranche with face value $F^S = (1/2 - \sigma)\, x$ and a junior tranche with face value*

$F^J = 1 - (1/2 - \sigma)\,x$, if sophisticated investors are sufficiently wealthy to buy the junior tranche: $A_S \geq V^J(\lambda_L)$, defined in (23). Otherwise, it is optimal to choose transparency, tranching and the sale of a fraction $\overline{s}^J = A_S/V^J(\lambda_L)$ of the junior tranche only if: (i) $\pi > (1-\overline{s}^J)V_O^J/[(1-p)(R-2C)]$ for $R \in [2C, 2C+\Delta)$ or (ii) $\pi > (1-\overline{s}^J)V_O^J/[(1-p)\Delta]$ for $R > 2C+\Delta$. In all other cases, tranching is irrelevant, and it is optimal to choose opaqueness and sell the issue (or both tranches) entirely.

Interestingly, the issuer's proceeds are always at least as large with tranching than without it, and the issuer will always sell all of the senior tranche and at most retains part of the junior one. Moreover, tranching expands the parameter region in which the issuer will go for transparency: not only transparency is preferred whenever sophisticated investors can absorb the entire junior tranche, but even if the issuer must retain a portion of it, transparency dominates in a larger region than without tranching. This can be easily seen by noticing that both of the necessary conditions on π in Proposition 7 are weaker than the corresponding conditions in Proposition 6, because $1-\overline{s}^J < 1-\overline{s}$, that is, the fraction of the junior tranche than the issuer must retain is smaller than the fraction of the ABS issue to be retained without tranching. Graphically, tranching causes both of the curves in Figure 5 to shift to the left, and therefore it expands the transparency region relative to the case of no tranching.

7 Conclusions

Is there a conflict between expanding the placement of complex financial instruments and preserving the transparency and liquidity of their secondary markets? Put more bluntly, is "popularizing finance" at odds with "keeping financial markets a safe place"? The subprime crisis has thrown this question for the designers of financial regulation into high relief.

The answer provided here is that indeed the conflict exists, and that it may be particularly relevant to the securitization process. Marketing large amounts of

ABS means selling them also to unsophisticated investors, who cannot process the information necessary to price them. In fact, if such information were released, it would put them at a disadvantage vis-à-vis the "smart money" that can process it. This creates an incentive for ABS issuers to negotiate with credit rating agencies a low level of transparency – that is, relatively coarse and uninformative ratings. Ironically, the elimination of some price-relevant information is functional to enhanced liquidity in the ABS new issue market.

However, opaqueness at the issue stage comes at the cost of a less liquid, or even totally frozen-up, secondary market, and of sharper price decline in case of default. This is because with poor transparency sophisticated investors may succeed in procuring the undisclosed information. Therefore, trading in the secondary market will be hampered by adverse selection, while with transparency this would not occur.

Though privately optimal, opaqueness may be inefficient socially if the freeze of the secondary market has negative repercussions on the economy, as by triggering a spiral of defaults and bankruptcies. In this case, regulation making greater disclosure mandatory for rating agencies is socially optimal. Our model therefore offers support for the current regulatory efforts to increase disclosure of credit rating agencies. However, it also indicates that there are situations in which opaqueness is socially optimal, for instance when the rents from private information are too low to lead to a secondary market freeze or when secondary market liquidity has little value.

We also analyze the effects of two forms of *ex-post* liquidity injection: one targeted at distressed investors in the context of a market freeze, and another aimed at supporting the ABS price in an illiquid secondary market. It turns out that the first policy, while efficient *ex post*, nevertheless diminishes the issuers' incentives to opt for transparent ratings *ex ante*, and also enlarges the parameter region where the market will freeze. The second type of intervention is even more misguided: the liquidity injected by the government to support the ABS market simply attracts more informed trading, so that distressed bondholders seeking liquidity do not benefit from it.

Finally, we show that in some cases regulation is not needed. First, if the demand for secondary market liquidity is strong or adverse selection in the primary market is not severe, issuers themselves will opt for transparent ratings. Second, issuers may themselves limit the size of their ABS issue and sell only to sophisticated investors. Or, even better, they may split the issue into an information-sensitive junior tranche for the sophisticates and a safe senior tranche for the unsophisticated. In both of these cases, they are more likely to opt for transparency than when they have to place a fixed ABS issue. Issuers, however, will opt for such policies only if sophisticated investors can absorb a sufficiently large portion of the issue. When this condition is not met, public intervention is still warranted.

Appendix

Proof of Proposition 6: If $R \leq 2C$, the optimal size is $s^* = 1$. This is because when $R \leq 2C$, there is no adverse selection problem in the secondary market.

If $R \in (2C, 2C + \Delta]$, the relevant comparison is between (20) (with $s = \overline{s}$) and $V_O - (1-p)\pi(R - 2C)$ (with $s = 1$). Equating the two expressions yields a lower bound on π as a function of R: if

$$\pi > \frac{(1-\overline{s})V_O}{(1-p)(R-2C)}, \tag{A1}$$

then $s = \overline{s}$ and transparency are optimal; otherwise, $s = 1$ and opaqueness are preferred. The lower bound (A1) is shown in Figure 4 as a downward sloping/convex with asymptote at $R = 2C$.

If $R > 2C + \Delta$, the comparison is (20) (with $s = \overline{s}$) and $V_O - (1-p)\pi\Delta$ (with $s = 1$). Equating these two expressions yields another lower bound on π as a function of R: if

$$\pi > \frac{(1-\overline{s})V_O}{(1-p)\Delta}, \tag{A2}$$

then $s = \overline{s}$ and transparency are optimal; otherwise, $s = 1$ and opaqueness are preferred. The lower bound (A2) is shown in Figure 4 as an upward sloping and concave curve intersecting the horizontal axis at $\pi = (V_O - A_S)/(1-p)\Delta$ and the vertical line corresponding to $\pi = 1$ at $R = \left[\frac{A_S}{V_O-(1-p)\Delta} - 1\right]\frac{V_O}{1-p}$.

The lower bounds (A1) and (A2) have the same value at their intersection, which occurs for $R = 2C + \Delta$:

$$\pi = \left[1 - \frac{A_S}{V_O + (1-p)(2C+\Delta)}\right]\frac{V_O}{(1-p)\Delta}.$$

The area where $s = \overline{s}$ is not empty only if this value is less than 1. This is easily seen to require $A_S > \overline{A}$ as defined in (22). Therefore, if $A_S \leq \overline{A}$, $s = 1$ and opaqueness are always optimal. ∎

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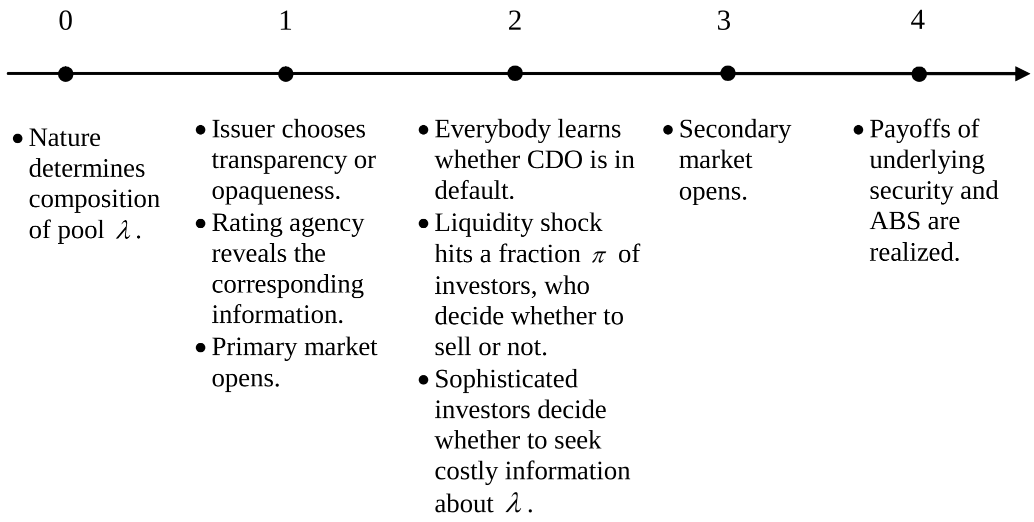

Figure 1: Time Line

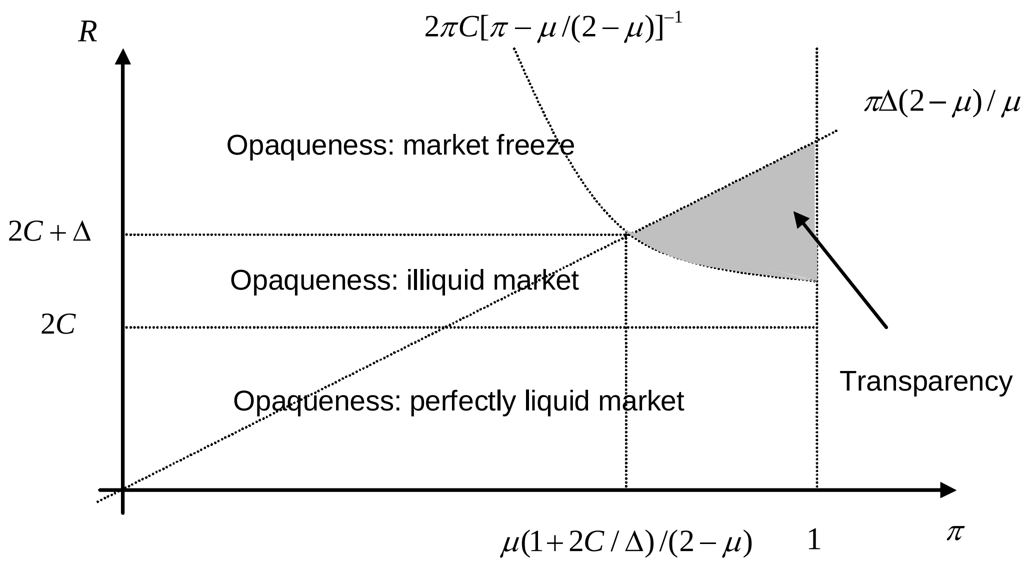

Figure 2: Privately Optimal Choice of Transparency

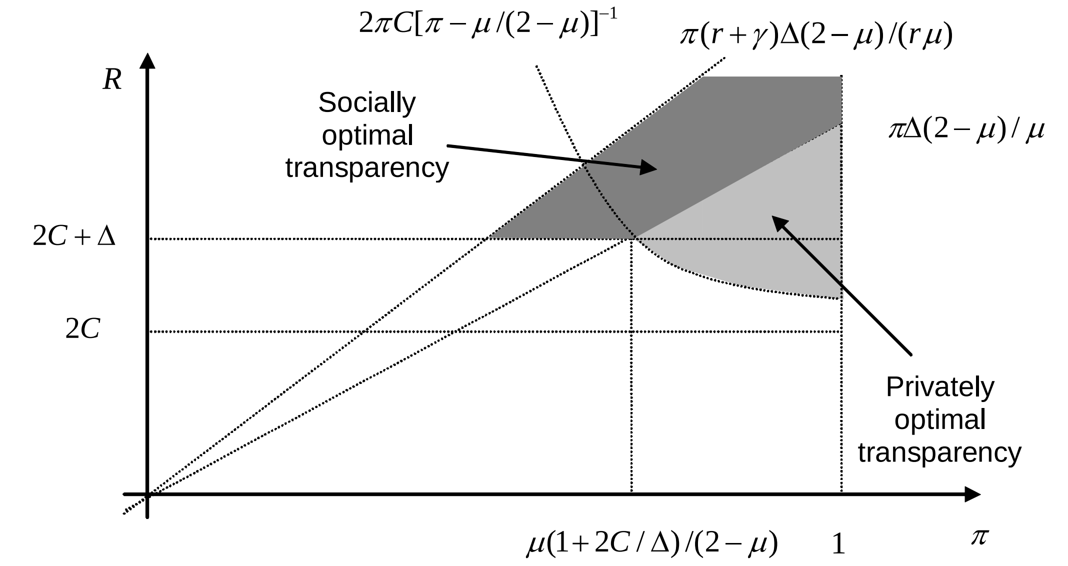

Figure 3: Socially Optimal Choice of Transparency

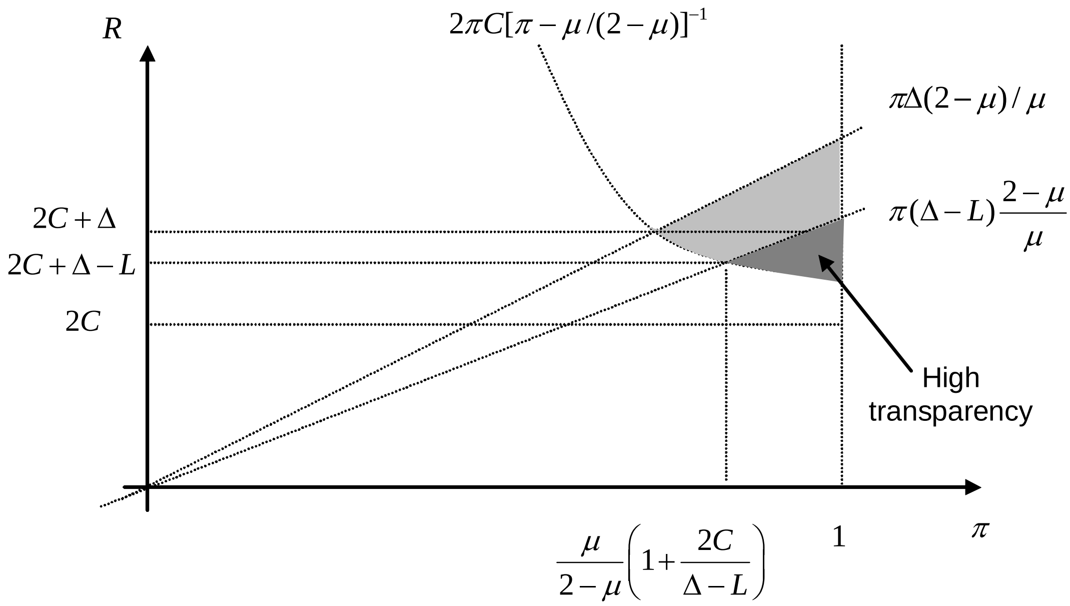

Figure 4: Public Provision of Liquidity and Private Choice of Transparency

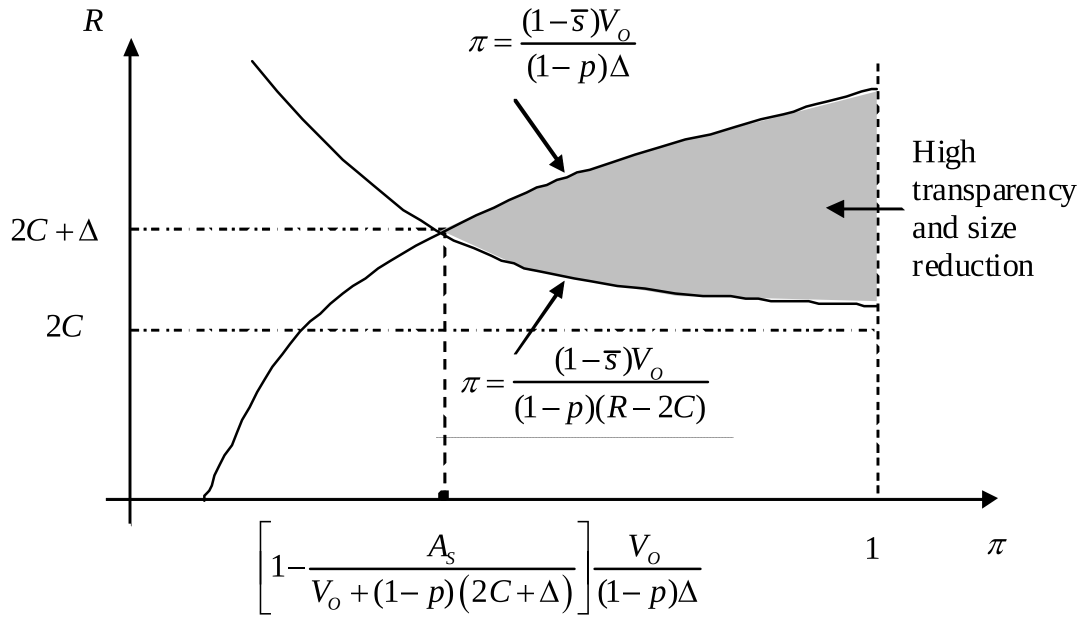

Figure 5: Choice of Transparency and ABS Issue Size